punch planting

As it pushes its way to the surface, the naked seedling must overcome many problems—crusting, weeds, salinity, to name a few. It's a wonder it ever makes it. A way to plant seeds at greater than normal depths may lead to several new concepts in seedbed preparation and planting.

by John W. Cary

PUNCH PLANTING IS JUST what it sounds like—punching a seed into the soil. We think that punch planting may be a solution to several problems that cause poor seedling emergence, especially soil crusting.

Last year several scientists at the Snake River Conservation Research Center in Idaho were working on the problems of seedling emergence. We found that when a soil crust was punctured with a hole just large enough in diameter to accommodate a seed, satisfactory emergence could be achieved by simply dropping the seed into the hole. Germination proceeds normally in the bottom of the hole, although the seeds are not covered with soil. Even lettuce and carrots germinate well. These crops are difficult to establish unless seedbed conditions are ideal.

Easing birth pangs

In greenhouse experiments, we placed lettuce and carrot seeds on a dry soil surface and punched them 2 inches into the soil with a pencil. When we kept crusts from forming by irrigating daily, 75 percent of the punch planted seeds produced healthy plants. This compares to 85 percent from seeds that were planted at the conventional one-quarter inch depth. But when the surface was allowed to dry and develop a thin crust, less than 1 percent of the conventionally planted seeds emerged, while 50 percent of the lettuce and 41 percent of the carrot seeds grew from the 2-inch deep holes.

GRANT HEILMAN

In April 1967, we set out a sugar beet trial on field plots. Before planting we packed the soil with a lawn roller to provide a smooth, stable surface that would help keep soil from caving in around the edges of the holes. A smooth, firm soil surface also lessens the danger of frost because it warms more quickly in the spring and holds more heat. Holes 2-inches deep were made by pushing a pencil into the soil and pelleted sugar beet seeds were dropped into them. Some rows were lightly sprayed with a 3-inch strip of asphalt emulsion to further raise the temperature of the seed zone and to stabilize the soil surface. As a check, other rows were planted to sugar beets in the conventional manner and some were sprayed with a strip of asphalt. The results favored the punch planting method. The seedlings emerged from the holes slightly earlier and produced a better stand.

Later in the spring we planted sweet corn and pinto beans in field plots. Because of the diameter of holes needed to accommodate the seeds of these crops, the depth must be greater than 2 inches to prevent the soil from

drying before the seedling roots. Consequently, we planted the corn and beans 8 inches deep in holes 1 inch in diameter. Because the seeds were so deep in the soil, the temperature around the seed and new roots was several degrees less than the temperature around the conventionally planted seeds. While cool root temperatures sometimes are desirable, such as when starting head lettuce in the Southwest, they are generally a drawback in cooler climates.

Cave-ins

Another problem was rain just after planting, which could wash soil into the holes and bury the seeds. It did happen that nearly an inch of rain fell on the corn shortly after planting, causing 2 to 3 inches of soil to wash in on top of the seeds. The beans were planted after this rain so they were not covered.

The yields of punch planted sweet corn were not statistically different from normally planted corn. We noticed that early in the season plants growing from holes had longer, more slender leaves than those conventionally planted. At harvest the corn planted in holes had an extra elongated section between the primary and support roots. This might reduce lodging caused by strong winds during summer thunderstorms.

The punch planted beans did not yield as well as the controls. I believe that this was due, not to the cooler soil temperatures, but to a difference in the secondary rooting pattern caused by loose soil which eventually filled in the holes. Beans in this area are subject to severe root rot and must form secondary roots along the stem to survive. The punch planted beans did not form as vigorous secondary lateral roots as the check plants. This could, perhaps, have been overcome with an appropriate tillage operation to firm up the soil against the stems after the plants are 6 to 8 inches high.

Our preliminary experiments indicate that punch planting may help reduce damage from soil crusts and create a surface more resistant to frosts. During our field trials soil crusts did not form because the weather was cool and wet. Nevertheless, the results indicate punch planting does not hold back yields when soil tilth is good. Punch planted crops emerged and yielded as well as conventionally planted crops.

Looking ahead

Potentially, punch planting is more than just a better way of planting in soils that tend to crust. Here are several questions we are considering:

▶ Beans are planted about the 20th of May in the middle Snake River

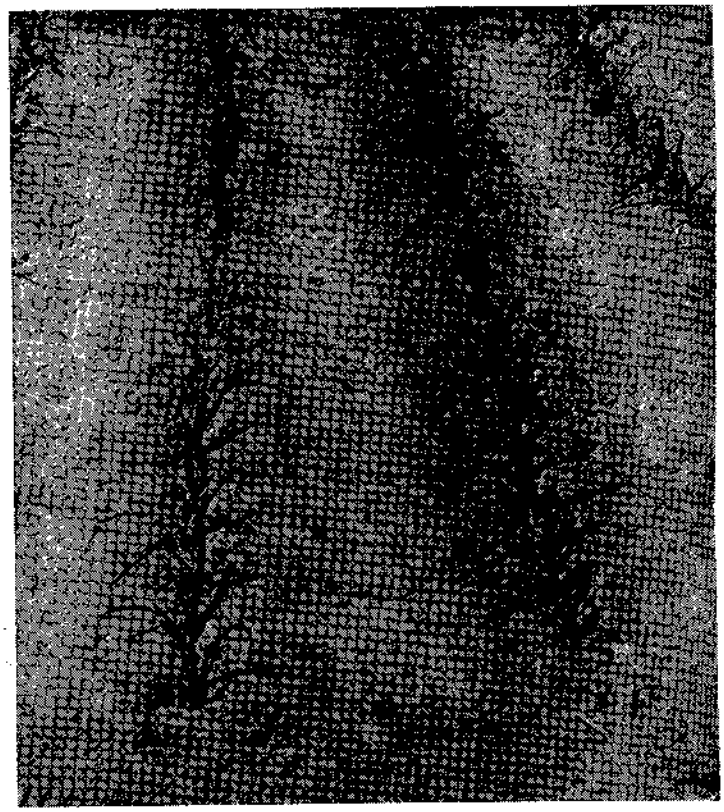
Punch planting is no drawback when soil conditions are normal: Emergence of sugar beets and . . .

Planting	Days after planting 20	26	39
		percent	
Normal	2	72	71
Punch	16	78	80
Normal with asphalt strip	38	80	77
Punch with asphalt strip	66	83	83

. . . emergence and yield of sweet corn and pinto beans.

Planting	Emergence Corn	Beans	Yield per acre Corn*	Beans
	percent		tons	sacks
Normal	91	83	8.5	30
Punch	92	79	8.1	25

*Tons of field picked ears per acre.



Above, row on left has corn seedlings that were punch planted in holes 8 inches deep. The seedings have long, slender leaves characteristic of punch planted corn. Row on right was conventionally planted.

Right, punch planted corn seedlings emerge from holes 8 inches deep.

Valley. While winter precipitation provides enough soil moisture at the 6 to 10 inch depth, the normal seedbed zone is so dry that it must be pre-irrigated to insure a good stand. Would it be possible to establish a stand by planting seeds in holes 8 inches deep to eliminate pre-irrigation and all the associated tillage operations?

▸ Evidence is accumulating that many plants rooted in cool soil grow more slowly and transpire less water, than plants in warm soil. Would a crop such as corn planted 8 to 10 inches deep on land with limited moisture grow more slowly using less soil moisture and thus be able to survive a longer period of drouth?

▸ As soil dries, salts slowly concentrate at the surface. In saline areas, this may cause poor germination and slow seedling growth. If the seeds were punched in two or three times deeper than their normal planting depth, that is, below the zone of salt concentration, would the growth of the seedlings proceed more normally?

▸ Herbicides are becoming an important factor in soil management. While some chemicals are quite effective in controlling weeds, growers increasingly report "set back" to tender crops such as sugar beets and beans. Would it be possible to incorporate some of the pre-emergence type herbicides in the surface inch of soil and then punch plant crop seeds so that the root systems of the young plants would not come in contact with the chemicals even though the normal emergence of weeds through the surface was controlled?

▸ Wind erosion is a serious problem in many agricultural areas of the western United States. This can, in general, be controlled in winter and early spring by planting a fall cover crop. Instead of plowing under the cover crop to prepare a normal seedbed in the spring, would it be possible to kill the crop chemically and then, without performing any tillage operation, punch plant the seeds in the stable surface caused by the cover crop's roots?

Of course we cannot begin to answer these questions without further field trials, but if the results of these studies do continue to support our optimism, the next question will be: How can punch planting be mechanized? Several agricultural engineering centers across the United States are presently developing precision planting machinery. It appears that planting single seeds in holes will fit in nicely with these developments. ★

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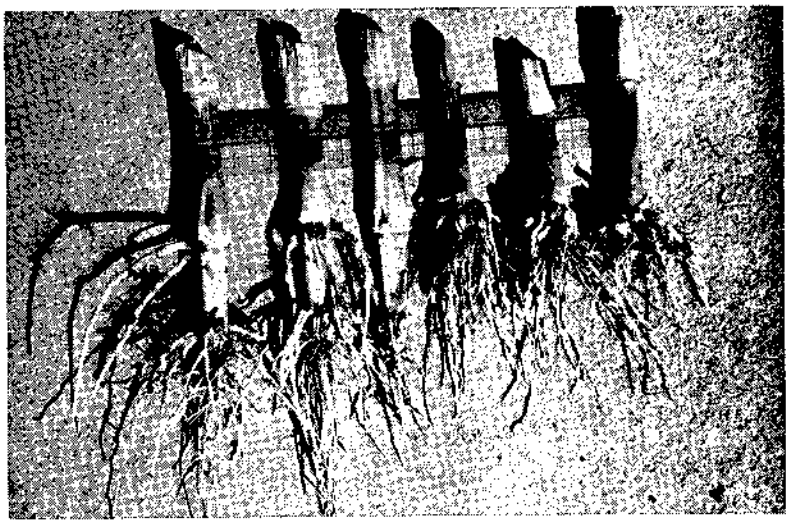
Right, corn plants show the effect of punch planting on development. Three plants on left were punch planted and have an elongated section between the primary and support roots. The three plants on right were planted conventionally.



Right below, punch planted bean plants (three on right) have less lateral root development than conventionally planted beans. Lack of lateral roots could be a problem where root rot is severe.